IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel. W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA Plaintiffs, vs. 1. TYSON FOODS, INC., 2. TYSON POULTRY, INC., 3. TYSON CHICKEN, INC., 4. COBB-VANTRESS, INC., 5. AVIAGEN, INC., 6. CAL-MAINE FOODS, INC., 7. CAL-MAINE FARMS, INC., 8. CARGILL, INC., 9. CARGILL TURKEY PRODUCTION, LLC., 10. GEORGE'S, INC., 11. GEORGE'S FARMS, INC., 12. PETERSON FARMS, INC., 13. SIMMONS FOODS, INC., and 14. WILLOW BROOK FOODS, INC., Defendants.	)	Case No. 4:05-cv-00329-GKF-SAJ

EXPERT REPORT OF DR. CHRISTOPHER M. TEAF

Qualifications & Experience

1. My name is Dr. Christopher M. Teaf. I am over 18 years of age and am competent to testify. All opinions presented in this statement reflect personal knowledge based on information and data that I have reviewed in this case. All

99% of that usage type occurs in the months of May through September (Caneday, 2008; Figure B3). Floating includes ancillary direct contact activities in the water such as swimming and wading as well, and reasonably can be considered to include an ingestion component of exposure, as well as dermal. Thus, a very large proportion of total annual land spreading of poultry waste is conducted during the months which just precede or overlap with the times of maximum direct contact recreational use of the Illinois River and its tributaries. Coincidentally, the rainy season in Oklahoma tends to be between February and June (NOAA, 2000), which coincides with and immediately follows the highest rates of waste application (Adamski, 1987; Adamski & Steele, 1988; Fisher, 2008). The rainy season also immediately precedes the highest rates of floating activity (Figure B4). On average, approximately 45% of annual rainfall in Northeast Oklahoma occurs between the months of February and June (NOAA, 2000). Rainfall, specifically when it occurs shortly after land spreading, results in microbial pathogen distribution as a result of runoff from spread poultry waste or by leaching through the soil profile (Giddens and Barnett, 1980; Gagliardi and Karns, 2000; Fisher, 2008; Olsen, 2008), even if buffer zones are used correctly, which they frequently are not.

26. Recently, over six consecutive years (2000-2005), there has been widespread measurement of the presence of indicator organisms in surface waters of the IRW, which indicate that those waters broadly and regularly exceed the Oklahoma Water Quality Standards and/or health-based screening levels (OWRB, 2007; CDM, 2008). Single point criteria for surface water along the impaired water body segments from recreational seasons 2005-2007 were exceeded in a large number of samples. Most of these samples are at least twice the standard and the values may exhibit exceedances up to a maximum of 125 times the standard (Table B2). Another example of regular and widespread exceedances of particular interest exist in specifically identified public access (PA) locations (Figure B5), most of which are within impaired water body segments, where a remarkable 13 of 15 locations (nearly 90%) had results where one or more indicators were in excess of the Oklahoma standards for fecal bacteria as shown by indicator organisms (CDM, 2008). In addition to single point criteria, a number of multi-sample geometric means within impaired water body segments, according to the

procedures of the Oklahoma Water Resources Board, also showed exceedances. The State of Oklahoma mandates that a geometric mean calculation for Primary Body Contact Recreation have no less than five samples for any 30-day time frame of interest (OAC, 2007). Results for the recreational seasons of 2005-2007 show exceedances in all water bodies where sufficient samples were taken to perform the calculation, with those exceedances being in the range of 2 to 30 times the standard (Table B2). While Peacheater Creek, Tyner Creek, Tahlequah Creek, and a portion of the Illinois River did not have adequate sampling frequency within the specified time frame to fairly calculate the geometric mean, the percentage of single point criterion exceeding the standard was in most cases nearly 20% of the samples, at levels that were 2 to 65 times greater than the health-based screening level (CDM, 2008; Table B2). These results, in my opinion, demonstrate a chronic and persistent problem of bacterial contamination which represents an imminent and substantial endangerment.

27. In addition to Primary Body Contact Recreation uses associated with surface water exposures, significant exposures to contaminated groundwater can occur through drinking water supplies as well. In Oklahoma, groundwater is protected such that bacterial levels in groundwater must be "nondetect", which is reasonable based on the absence of normal bacterial fauna in groundwater at deeper depths (NRC, 2004; EPA, 2006A; USGS, 2007b). Once groundwater pollution has been determined to have occurred via human activities, the water supply is to be restored to a quality sufficient to support its designated beneficial use, in this case potable water supplies (OAC, 2007). Over 1,700 groundwater wells have been identified in the Oklahoma portion of the IRW, of which 98% are used for domestic purposes (OWRB, 2008; Fisher, 2008; Figure B6). Figure B7 illustrates the CDM groundwater well sampling sites within the IRW while Figure B8 shows the locations of Geoprobe samples taken within the IRW. Bacterial contamination of groundwater, including impacts by *E. coli*, fecal coliforms and enterococci, has been demonstrated in many shallow wells and in other wells at depths to approximately 150 feet, as well as in a majority of shallow groundwater Geoprobe samples (CDM, 2008). Olsen (2008) identified the poultry "signature" in the majority of these samples. While these Geoprobe samples are not necessarily

completed to depths from which groundwater is taken for domestic purposes, they clearly demonstrate the potential pathway between microorganisms at the surface and those which can contaminate groundwater. These elements further demonstrate the vulnerability of shallow groundwater (NRC, 2004; Fisher, 2008), and illustrate the health concerns that are associated with land spreading of poultry waste in areas where groundwater is used for potable and other domestic purposes.

28. Bacterial levels of human health significance also have been found in a number of springs within the IRW. At their point of release from the ground, where they "daylight", springs represent a transition from groundwater to surface water. Thus, they can be indicators of impacts to groundwater and/or surface water (Fisher, 2008). Springs sampled in the Oklahoma portion of the IRW are shown in Figure B9. Approximately 21% of the spring samples exceeded the surface water bacterial standards. Most of those samples were located in close proximity to the Illinois River and its tributaries. Olsen (2008) concluded that nearly 40% of spring samples were impacted by poultry waste.

29. Bacteria have been detected in surface water, groundwater and springs in the IRW at levels that are indicative of significant concern from a human health perspective (CDM, 2008). Edge-of-Field samples for fields that have received recent spreading of poultry waste have shown bacterial colony counts in water which are similar to those reported for water samples into which, raw, untreated sewage (i.e., 10^5 or 100,000 MPN or greater) has been spilled from U.S. sewage treatment plants (Metcalf & Eddy, 1991; Brosnan et al., 1996; CDM, 2008; Harwood et al., 2005). Of the 22 Edge-of-Field sample locations which exhibited bacteria and indicator organism results in excess of 100,000 MPN per 100 milliliters, seven of the locations exhibited results for enterococci, fecal coliforms and/or total coliforms greater than or equal to 1,200,000 MPN per 100 milliliters, with three sites having a total of 5 reports of greater than or equal to 1,600,000 MPN per 100 milliliters (Table B6). Through Principal Component Analysis (PCA), it has been determined that 100% of the Edge-of-Field samples showed poultry related impacts. Furthermore, of the 50 highest "PC1" (poultry) scores of all sampled media, 44 were Edge-of-Field samples, with the highest score resulting in a sample